

## Lesson III.

### Petroleum

#### I.

sense [sens] – n	смысл; значение In the dictionary the different <i>senses</i> of each word are marked by numbers.
embrace [ɪmˈbreɪs] – v	включать, заключать This course <i>embraces</i> several different aspects of psychology.
refer to as [rɪˈfəː] – v	называть The students <i>refer</i> to Prof. Johnson's course of chemistry as the black magic course.
share [ʃeə] – v	разделять, делить; распределять We don't have enough books so you'll have to <i>share</i> .
infinite [ˈɪnfɪtɪ] – a	бесконечный, безграничный The universe is <i>infinite</i> .
attach to [əˈtætʃ] – v	прикреплять к, связывать с, присоединять к <i>Attach</i> a recent photograph to your application form.
degree [dɪˈɡriː] – n	степень; градус 1) To a <i>degree</i> , it is possible to educate oneself. 2) The temperature dropped to five <i>degrees</i> Centigrade.
combustion [kəmˈbʌstʃən] – n	горение, сжигание, окисление <i>Combustion</i> is chemical activity which uses oxygen to produce light and heat.
bond – n	связь There are strong <i>bonds</i> of friends between them.
bond – v	связывать, соединять Carbon atoms can <i>bond</i> together in rings.
involve – v [ɪnˈvɒlv]	вовлекать, вовлечь, впутывать; вызывать (влечь за собой) I don't want to be <i>involved</i> in the arguments.
eventually [əˈventʃəli] – adv	в конечном счёте, в конце концов <i>Eventually</i> , she got a job and moved to London.
range [ˈreɪndʒ] – v	находиться в пределах, колебаться There were 120 students whose ages <i>ranged</i> from 10 to 18.
range [ˈreɪndʒ] – n	предел Your blood pressure's well within the normal <i>range</i> .
ability [əˈbɪlɪti] – n	возможность, способность The health center serves all patients, regardless of their <i>ability</i> to pay.
boundary [ˈbaʊndəri] – n	граница, линия раздела The Mississippi River forms a natural <i>boundary</i> between Iowa and Illinois.
arbitrary [ɑːˈbɪtrəri] – a	произвольный The way the programme of events of the Festival is organized seems completely <i>arbitrary</i> to me.
fairly [ˈfeəli] – adv	довольно, в известной мере A <i>fairly</i> narrow range of people are responsible for key decisions.
accomplish [əˈkʌmplɪʃ] – v	выполнять, совершать As you <i>accomplish</i> tasks, cross them off your list.
predominant [prɪˈdɒmɪnənt] – a	преобладающий, доминирующий In this painting, the <i>predominant</i> colour is black.

predominate [pri'dɒmineɪt] – v	преобладать, господствовать This is the district where Democrats <i>predominate</i> .
particularly [pə'tɪkjʊləli] – adv	особенно, в особенности Credit cards are <i>particularly</i> useful when travelling.
inherently [ɪn'hɪərəntli] – adv	присуще, неотъемлемо Firefighting is an <i>inherently</i> dangerous occupation.
degrade [di'greɪd] – v	ухудшать(ся), разлагать(ся) 1) If sulphur hexafluoride is subjected to electrical sparking in the presence of oxygen, it <i>degrades</i> , releasing toxic breakdown products. 2) Erosion is <i>degrading</i> the land.
volume ['vɒljʊm] – n	объём, масса, ёмкость The <i>volume</i> of the container measures 10,000 cubic metres.

## II. Recognize familiar words of foreign origin and give their Russian equivalents:

hydrocarbon [ˌhaɪdrəʊ'kɑ:bən], ground [graʊnd], condensate [ˌkɒndən'seɪt], composition [ˌkɒmpə'zɪʃn], combine [kəm'baɪn], produce [prə'dju:s], dioxide [daɪ'ɒksaɪd], result [rɪ'zʌlt], term [tɜ:m], container [kən'teɪnə], matter ['mætə], normal ['nɔ:məl], group [gru:p], arbitrary [ɑ:'bɪtrəri], physical ['fɪzɪkəl], industry ['ɪndʌstri], classification [ˌklæsɪfɪ'keɪʃn], individual [ˌɪndɪ'vɪdʒuəl], predominant [pri'dɒmɪnənt], limit ['lɪmɪt], deasphalting [dɪæs'fæltɪŋ], contact ['kɒntækt], meteoric [mi:'tɪɔrɪk], biodegradation [ˌbaɪo(u)ˌdegrə'deɪʃn], gasoline ['gæsəli:n], kerosine ['kerəsi:n], liquidate ['lɪkwɪˌdeɪt].

## III. Group the words into families according to their similar roots.

### Translate them using a dictionary if necessary.

arrangement, combining, arranged, composer, substance, simple, compose, condensed, composing, contribute, simplify, composed, combination, composite, ability, vaporability, liquid, condensate, combined, simplicity, able, composition, contribution, liquify, vaporation, combine, arrange, substantial, substantially, vapour, capability, enable.

### Text I

The word “petroleum” commonly used in its broadest sense *embraces* all naturally occurring hydrocarbon substances in underground reservoirs. Hydrocarbons which are liquid in the reservoir are referred to as “crude oil” or simply “oil”; hydrocarbons which are gaseous in the reservoir are *referred to* as “natural gas” and liquid substances which are in vapour form in the reservoir are referred to as “condensate”. Both oil and natural gas can contain non-hydrocarbon components. If present, these usually contain nitrogen, oxygen and sulphur.

Hydrocarbons are chemical compounds whose molecules are composed of atoms of solely two elements – carbon and hydrogen. It is this composition that makes them such important sources of energy, for when combined with oxygen to produce carbon dioxide and water, the combustion reaction produces a very large amount of energy.

Carbon is known to have a chemical characteristic which is only shared by a few other elements to a much lesser degree. The carbon atom can *bond* itself to other carbon atoms, which, when other elements are attached, can build up very large and complex molecules, resulting in an almost infinite variety of chemical compounds. Since living organisms are commonly *involved* in the production of these compounds, the study of carbon compounds is usually termed organic chemistry. Thus, organic compounds formed by living organisms mainly of plant kingdom, are the original matter from which petroleum is *eventually* formed.

Because of the *ability* of the carbon atom to bond itself to other carbon atoms, there are a large number of hydrocarbon compounds, the molecules of which can contain 1 to 50 carbon atoms. They are found *to range* from gases through liquids to solids. Chemically they can be

divided into four main groups by nature of the carbon bonds and the arrangement of the carbon atoms in the molecule, these groups being the aromatics, the naphthenes, the branched-alkanes and the normal alkanes.

A physical grouping of hydrocarbons can be made by classifying them into groups according to molecular size (number of carbon atoms per molecule) and the arrangement of the atoms in the molecules. The *boundaries* between the groups are more or less arbitrary, following the changes in physical characteristics. The usual industry classification is:

gases  $C_1$ -  $C_3$   
gasoline  $C_4$  –  $C_{10}$   
kerosine  $C_{11}$  –  $C_{12}$   
gasoil  $C_{13}$  –  $C_{20}$   
lubeoil  $C_{21}$  –  $C_{40}$   
residium  $C_{40}$  plus

Depending on the origin, individual accumulations of petroleum can range from gases where methane ( $CH_4$ ) is *predominant* through condensate or light oil where the gasoline and kerosine compounds predominate to heavy oils where  $C_{20}$  plus components are predominant.

It should be mentioned that oil in reservoirs can be subjected to three other processes: (a) deasphalting when the reservoir is in contact with downdip migrating gas; (b) water washing when the reservoir is in contact with moving meteoric water and (c) biodegradation when meteoric waters introduce aerobic bacteria. A combination of (b) and (c) is sure *to degrade* large *volumes* of crude oil to heavy tar.

#### **Notes:**

1. in its broadest sense – в самом широком смысле слова
2. in vapour form – в виде паров
3. if present – если таковые (неуглеводородные соединения) имеются
4. solely two elements – лишь из двух элементов
5. source of energy – источник энергии
6. which is shared by a few other elements – которая имеется у некоторых других элементов
7. when other elements are attached – когда к нему присоединяются другие элементы
8. more or less arbitrary – более или менее произвольно
9. by nature of the carbon bond – по характеру углеродной связи
10. downdip – стекающий (вниз), вниз по падению

#### **IV. Find English equivalents in the text.**

объединять все углеводороды; подземный коллектор; сырая нефть; природный газ; в виде паров; газоконденсат; только два элемента; именно этот состав углеводородов делает нефть ...; так как; с образованием двуокиси углерода и воды; реакция горения; химическая характеристика; в гораздо меньшей степени; может сам присоединяться к другим углеродным атомам; может образовывать сложную молекулу; давая (образуя) почти бесконечное количество химических соединений; изучение соединений; растительный мир; из-за (благодаря) способности углеродного атома; характер углеродной связи; расположение атомов; согласно размеру их молекул; границы между группами; более или менее произвольны; нефть подвергается трём другим процессам; деасфальтизация; газ мигрирующий вниз по падению (пласта); протекающая пластовая метеорная вода; приносить аэробные бактерии; ухудшать нефть; тяжёлый остаток.

#### **V. Identify the “ed” – form as Participle II in the attributive function. Remember that Participle II as an attribute is often placed after the noun which it defines.**

Example: 1. The concept proposed agreed with the experiment observation.

Предложенная теория соответствовала экспериментальным наблюдениям.

2. Our laboratory installed automated equipment.

В нашей лаборатории установлено автоматизированное оборудование.

3. The equipment installed automated our laboratory.

Установленное оборудование сделало нашу лабораторию автоматизированной.

1. Petroleum formed from organic matter deposited in sediments is known to be of great commercial value to-day.
2. Bitumen is known as a matter composed of asphaltenes, resins and also hydrocarbons derived from organic matter.
3. The methods applied increased the accuracy of the results.
4. Pr. Belov theoretically predicted complicated interaction between the components involved in the process.
5. At that time the problem presented increased the danger of radioactive contamination (загрязнение) in the laboratory concerned.
6. The hypothesis concerned synthesized materials and did not apply to natural products.
7. The crystal produced revealed cracked faces.
8. The method proposed provided the required mechanism of reaction.
9. The trend observed is explained in the following way.
10. Heat supplied to the liquid in the process of boiling is retained in the vapour even if this heat is removed.
11. By application of the above-mentioned process to crude oil and its fractions, a limited number of refined oil products are produced.
12. A fraction separated by distillation contains more or less of each type of fractions, depending on its boiling range and the crude oil used.
13. The mechanism of the process involved turned out to be very complicated.
14. Automated information processing radically modified the method tested.
15. Carbonized residue in petroleum converted into methane is likely to occur at depth of over 3,500 meters.
16. The technique applied provided the required mechanism of reaction.

**VI. Use the conjunction with the following participles and give the Russian equivalents to the word groups thus made.**

Example:

A. When considered – при рассмотрении

discussed, converted, refined, treated, compared, accumulated, classified, derived, deposited, combined, heated, cooled, attached, arranged;

B. If applied – при применении

analyzed, considered, obtained, attacked, composed, involved, joined, united, decreased, increased, treated, manufactured, dissolved;

C. As stated above – как указывалось выше

identified, defined, predicted, pointed out, found out, compared (with), opposed (to), said, reported;

D. Once used – будучи использованным

applied, used, introduced, established, created, developed, assumed, recognized.

**VII. Translate into Russian the following sentences with adverbial participle II construction:**

Example: When cooled, the body contracts.

- a) при охлаждении тело сжимается
- b) когда тело охлаждается, оно сжимается.

1. If properly treated, these raw materials can provide us with all necessary substances.
2. All materials normally expand when heated and contract when cooled.
3. What is so unusual about the environmental problem when compared to other ones?
4. The treatment was expensive and the disposal of the spent acid and constituents so removed presented a difficult problem.
5. Once started, the process is difficult to stop.
6. Ceramic superconductors are known to lose all electrical resistance when chilled with liquid hydrogen.
7. When exposed to air at room temperature, phosphorus begins to oxidize.
8. Copper does not combine with oxygen when cold, but it does so slowly when heated.
9. If properly cycled, all metals, glass, paper, fabrics and the like could provide raw materials for different industries.
10. As delivered to the consumer, natural gas consists essentially of methane, CH<sub>4</sub>.
11. Thermoplastics can be resoftened and reshaped by heating if desired.
12. The difference in the behaviour is due to differences in the molecular structure of thermoplastics and thermosets, as already explained and is reflected in the difference in the processing techniques applied to the two types.
13. Once started, the reaction may proceed very violently.
14. Nitrogen bases often cause discoloration of heavy gasolines and kerosines, particularly when associated with phenols.

**VIII. Identify and state the predicate of the sentence among other verbal forms.**

1. The presence of aromatic hydrocarbons in kerosene produces smoky flame when burnt in a lamp.
2. The undesired aromatic hydrocarbons can be recovered unchanged and the refining agent can be recovered as well and reused.
3. Each of the fractions obtained in a simple one-stage process, as described above, contains some of the components of the other stage.
4. The most commonly used solvents are phenol and sulfolane acetonitrile.
5. The Dubbs process can be operated in two ways according to the products required.
6. The hydrogen required is prepared by methane/steam or naphtha/steam reforming.
7. Here the lighter hydrocarbons are removed and the reformed products called "platformate" can be broken down into light and heavy grades if desired.
8. The properties of alkylates depend on the type of feedstock used.
9. The product obtained by polymerization from the basic molecule, the monomer, is called a polymer.
10. The activated clay used in the process concerned cannot be regenerated.
11. The type of synthetic detergent used depends on the type of fibre, the type of soiling matter and the results required.
12. The most commonly used phenol is diphenylpropane made by reaction of phenol with acetone.
13. Once started, these reactions evolve much heat.

**IX. Match the adverbs in A and those in B.**

**A**

1. usually
2. originally
3. mainly
4. finally
5. really
6. accordingly
7. nearly
8. gradually
9. highly
10. entirely
11. appropriately

**B**

1. approximately/roughly/about
2. properly/suitable/adequately
3. commonly/as a rule
4. in the end/at last/at length
5. basically/fundamentally/principally/chiefly
6. correspondingly/consequently/respectively
7. eventually/little by little/progressively
8. actually/in fact/ indeed/generally
9. initially/at first
10. extremely/very/most
11. totally/fully/completely

**X. Match the prepositions in A and those in B.**

**A**

1. with the help of
2. according to
3. with the exception of
4. regarding to
5. in addition to
6. instead of
7. not far from
8. in spite of
9. owing to

**B**

1. in accordance with/under
2. thanks to/due to
3. in place of
4. besides/along with
5. by means of/by/through
6. near/next to/close to
7. with regard to
8. except (for)
9. despite

**XI. Match the adjectives in A and those in B.**

**A**

1. various
2. evident
3. mean
4. vital
5. adequate
6. similar
7. initial
8. permanent
9. transparent

**B**

1. identical/the same/alike
2. important/essential
3. original/primary
4. sufficient/suitable
5. obvious/appearent
6. continuing/stable/lasting
7. different/diverse
8. average/typical/ordinary/normal
9. clear

**XII. Match the verbs in A and B.**

**A**

1. break down
2. arrange
3. specify
4. originate
5. continue
6. employ

**B**

1. enter into/incorporate/unite/combine
2. put in/place/organize/group
3. use/utilize/make use of/apply/exploit
4. act on/react/interact/cooperate
5. proceed /go on/keep up/last
6. determine/define/find/decide on/assess

- |             |   |
|-------------|---|
| 7. include  | 7. account for/clear up                         |
| 8. join     | 8. crack/split/decompose/disrupt                |
| 9. attack   | 9. derive from/come from/result from/arise from |
| 10. term    | 10. consist of/contain/to made up of            |
| 11. explain | 11. refer to as/denote/identify (as)/describe   |

### **XIII. Match A & B**

<b>A</b>	<b>B</b>
1. attach	a) to include something as part of a subject, discussion, etc
2. eventually	b) to have the same opinion, quality, or experience as someone else
3. predominant	c) without limits in space or time
4. inherent	d) connect one object to another [=fix]
5. degrade	e) a unit for measuring temperatures and angles
6. accomplish	f) the process of burning
7. share	g) the limits within which amounts, quantities, ages etc vary
8. combustion	h) decided or arranged without any reason or plan, often unfairly
9. refer to as	i) to succeed in doing something, especially after trying very hard
10. infinite	j) more powerful, more important, or more easily noticeable than others
11. degree	k) a natural part of it and cannot be separated from it
12. range	l) to make a situation or condition worse or weaker
13. embrace	m) to mention or speak about someone or something
14. arbitrary	n) in the end

### **XIV. Translate into Russian the following sentences with the verb “to involve” – ВКЛЮЧАТЬ В СЕБЯ; ВЫЗЫВАТЬ, ВОВЛЕЧЬ.**

- The further conversion of organic matter into oil involves some chemical reactions raising the carbon and hydrogen content but decreasing the oxygen content.
- The process in question involves violent (бурное) release of oxygen.
- Clearly in this case substances have been changed into other substances – a chemical change has been involved.
- The other way in which organic chemists work involves the synthesis and study of a large number of organic compounds.
- Manufacturing of monomers involves a series of steps, starting with the selected raw material.
- The methods under discussion may involve observation of the effect of heat alone upon the substance.
- Radiochemical techniques involve observation of radioactive substances.
- The separation of mixtures into compounds and elements does not involve chemical changes, i.e. changes in the composition of matter.
- This is well illustrated by the process of solution which may or may not involve changes in the composition of the materials involved.
- Let's take but one example of the problems involved.

**XV. Make notice of the word “due”, which, when used as an attribute, has the meaning of “должный, нужный, требуемый”, “be due to” – a verb – обуславливать, “due to” – прр. благодаря, из-за.**

1. Plastics are composed of large molecules and the difference in their thermal behaviour is due to differences in internal structure.
2. The disagreement concerning some approaches to this problem was clearly due to some misunderstanding.
3. The improved gasoline quality is due to formation of isoparaffins and aromatics.
4. Lubricant enables the moving parts of the engines to work without undue friction or wear.
5. Lubricating oil undergoes chemical and physical changes mainly due to oxidation.
6. An undue amount of carbon deposits from the oil must be avoided.
7. Gasoline composition has changed recently due to environmental concerns.
8. The property, like that of colour, is generally due to the presence of unpaired electrons in the compound.
9. The formation of coke on the catalyst in catalytic cracking is due to dehydrogenation and condensation reactions of polynuclear aromatics.
10. The operational severity of the first stage of regeneration is mild due to partial combustion.

**XVI. While doing this exercise, remember that the word “for” can be used in different functions: “for” – прр. «для, ради, за; в течение»; – сї. «в виду того, что; т.к., потому что».**

1. For solutions which deposit rather large amounts of crystals on cooling, the choice of equipment will be between a simple cooling crystallizer and a vacuum crystallizer.
2. The composition of hydrocarbon molecules makes them a very important source of energy, for when combined with oxygen to produce carbon dioxide and water, the combustion reaction produces a very large amount of energy.
3. Gas chromatography is mainly used for quantitative analysis for this method is suitable for the routine analysis of industrial samples.
4. This definition turned out to be not quite satisfactory, for many questions were immediately raised.
5. A new definition of an “element”, too, was unsatisfactory, for there is no real distinction between “chemical” and “physical” means.
6. For thousands of years it had been the dream of man to reach the moon and at last it came true.
7. For each aluminium atom introduced, therefore, a singly-charged cation or its equivalent must also be incorporated into the structure.

**XVII. Translate into English the following, using active vocabulary from Lesson III:**

1. Углеводороды могут быть газообразными, жидкими или твёрдыми при нормальной температуре и давлении.
2. Физическое состояние углеводородов зависит от количества и расположения углеродных атомов в углеводородных молекулах.
3. Если в молекуле углеводорода содержится свыше четырёх атомов углерода, то углеводород – жидкий, если в них содержится от 20 и более углеродных атомов, то она находится в твёрдом состоянии.
4. Большинство сырых нефтей представляют собой жидкие смеси, но они могут содержать также газообразные и твёрдые соединения.
5. Сырая нефть, когда её добывают из скважины, находится в жидком состоянии, имея температуру около 70<sup>0</sup>С.
6. Некоторые нефти становятся почти твёрдыми при охлаждении, вследствие кристаллизации твёрдых соединений.



7. Некоторые нефти остаются жидкими даже при низких температурах, если они содержат небольшое количество твёрдых углеводородов.
8. Простейшим углеводородом является газ «метан».
9. Углеродные атомы могут соединяться друг с другом различными типами связей – они могут быть прямые, разветвлённые и циклические цепи.

### **XVIII. Read the text carefully to yourself and be ready for a comprehension check-up.**

#### **Text II**

Hydrocarbons are compounds of hydrogen and carbon that at normal temperatures and pressures may be gaseous, liquid or solid depending on the relative proportion of the various hydrocarbons present in the mixture.

In its widest sense “petroleum” embraces all hydrocarbons occurring naturally in the earth. In its narrower, commercial sense, “petroleum” usually includes liquid deposits – crude oil, the gaseous ones being known as “natural gas” and the solid ones as “bitumen”, “asphalt” or “wax” according to their composition.

Most crude oils, although liquid as such, contain gaseous and solid hydrocarbons in solution.

The gases are known to come out of solution either on the release of pressure as the crude oil is produced or during the first stages of refining, and contribute to the total natural gas production. Some of the solids are recovered during refining as bitumen and wax, some remain in solution in the liquid oil produce. Natural gas is also found associated with crude oil as “gas cap” above the oil or unassociated with oil.

Crude oil and natural gas are the raw materials of the petroleum industry. It is the business of the industry to find them, to produce them from the ground, to process them and to manufacture technically useful products from them.

It should be also stressed that the world’s demand for oil continues to grow and had doubled by 1990 and it comes to 80,2 m.b/d.

Thus, for a century and a half the industry has grown into one of the most important in the world, remarkable for its size, complexity and geographical extent.

#### **Exercise I**

**Choose the correct answer and tick it:**

1. a) Hydrocarbons are solely liquid mixtures.  
b) Hydrocarbons may be gaseous, liquid and solid.  
c) Hydrocarbons may be liquid and solid.
2. Liquid hydrocarbons are usually referred to as:  
a) “condensate”; b) gas cap; c) petroleum.
3. a) Gases are known to enter petroleum in underground reservoirs;  
b) Gases are known to come out of solution during oil production and refining;  
c) Gases are known to remain in underground reservoir during oil production.
4. a) All solid compounds are recovered during refining.  
b) Only solid compounds are recovered during refining.  
c) Some of the solids are recovered during refining.
5. The world’s demand for oil was likely:  
a. to decrease  
b. to remain constant  
c. to double by 1990

#### **Exercise II**

1. Speak on “Hydrocarbons”.

**XIX. Learn the dialogue by heart:**

**DIALOGUE**

- I know you've been to oil wells and refineries in Iraq.
- Not only there but all over the world.
- Then, will you tell me the correct name for the substance that actually comes out of the wells?
- Well, that's petroleum, crude oil.
- Oh, those are the sort of answers I always get. Which is it? Petroleum or crude oil?
- Petroleum is crude oil, oil before it's refined. To be more exact, it's crude petroleum oil and we call it "crude" for short.
- Oh, I see. This crude oil, this petroleum, what's it like?
- It's a good question to ask but not easy to answer, as it varies from one oilfield to another.
- Oh! So there are different kinds of petroleum, aren't there?
- Well, they're mixtures of hydrocarbons. But it should be noted that no two oilfields ever produce crude of exactly the same composition.
- I'll be just quite happy with a general description, colour, for instance.
- Its colour ranges from yellow through green to black. The lighter its colour, the easier it is to pour. The liquids vary in density from thin to thick and viscous. Sometimes it may be too thick to pour at all.
- Oh, so it isn't always a liquid, is it?
- Oh no, not always. It can be both gas and vapour as well.
- By the way, what exactly is bitumen?
- Well, the type of bitumen usually found on the earth's surface is a residue from which all the more volatile elements have long since evaporated. It's black or brown solid, perhaps, or a very viscous non-crystalline liquid.

**XX. Render the following text, using active vocabulary of the previous Lessons.**

**Углеводороды и биомасса**

distinguishing feature	Химический состав—главная <i>отличительная характеристика</i> углеводородов: их молекулы состоят из атомов углерода и атомов водорода, <i>откуда и название</i> : «углеводороды».		
hence/from here	Углеводороды представляют собой ископаемую биомассу.		
be subdivided into	Углеводороды, в зависимости от их молекулярного веса <i>подразделяются на</i> три основных вида:		
liquefied gas	• газообразные	• жидкие	• твёрдые
	- природный газ	- нефть	- битумы
	- сжиженный нефтяной газ	- газовый конденсат	- уголь
			- гидраты природного газа

В природе существует большое количество веществ, которые не принято называть «углеводородами», хотя их молекулы тоже состоят из атомов углерода и водорода. Это *растительная целлюлоза*, фруктовый сахар и т.д. *Схожесть* химического состава углеводородов и некоторых видов биомассы отнюдь не *случайна*. Она указывает на то, что углеводороды образовались в далеком прошлом из биомассы. Действительно, и углеводороды, и уголь представляют собой ископаемую биомассу. Они являются ни чем иным, как

concentration, give rise to	<i>сгустком</i> солнечной энергии, <i>давшей</i> в свое время <i>жизнь</i> растениям и планктону. Процесс формирования углеводородов и угля очень длительный, он исчисляется многими миллионами лет. Таким образом, в масштабах истории человеческой цивилизации они не являются
renewable energy resource	« <i>возобновляемыми</i> » <i>энергоресурсами</i> .
fossil biomass	Тот факт, что углеводороды суть <i>ископаемая биомасса</i> , имеет огромное значение. Это означает, что в будущем люди в целом ряде областей смогут заменить нефть современной биомассой, которая имеет одно неоспоримое преимущество: она возобновляема. С другой стороны, концентрация энергии в биомассе значительно ниже, чем в углеводородах, формировавшихся на протяжении долгого геологического
shortcoming/drawback	периода, и в этом её существенный <i>недостаток</i> .

## XXI. Read the texts and be ready to discuss them.

### A. Energy Crisis

#### Text III

As stated above, all our energy comes from fossil fuels (oil, natural gas and coal). The earth's reserves of fossil fuels have been formed from organic matter subjected to enormous heat and pressure for millions of years. But such reserves are not infinite, because power demand is increasing rapidly, fossil fuels are expected to be exhausted within some time, approximately by the middle of the 21st century. Of course, long before fossil fuels are exhausted, demand will greatly exceed supply.

In the early 1970s the world at last realized that fossil fuels are a precious gift of nature and their supply is strictly limited. As a result, attention has turned to the pressing need of developing alternative sources of energy.

The principal energy supplies are known to be: solar radiation which accounts for more than 99%, winds, waves, and currents; and the energy from nuclear, thermal and gravitational sources. Since fossil fuels are not infinite, scientists are now actively developing these alternative sources of energy.

The world faces, then, three immediate tasks. To extend the life of fossil fuels all countries must reduce energy consumption and in preparation for the time when fossil fuels run out, alternative resources of infinite, cheap and convenient energy must be developed.

#### Notes:

1. power demand – потребность в энергии
2. long before – задолго до того, как
3. demand will greatly exceed supply – спрос будет значительно превышать обеспечение
4. precious gift – бесценный дар
5. pressing need – острая необходимость
6. currents – течения, потоки
7. extend life – продлить жизнь

### I. Insert the proper words from Text III:.

(as well, living, infinite, fall, drop, last, face, reserves, cheap and convenient, extracted, therefore, twenty-first, present).

Fossil fuel reserves are not \_\_\_\_\_. The world will \_\_\_\_\_ a major crisis by the end of the \_\_\_\_\_ century: shortage of \_\_\_\_\_ and \_\_\_\_\_ energy. For without such energy industrial production will \_\_\_\_\_, agricultural output will \_\_\_\_\_, transport will be restricted and standards of \_\_\_\_\_ in developed countries will go down \_\_\_\_\_. Can we calculate how long these reserves will \_\_\_\_\_ if \_\_\_\_\_ trends of exploiting them continue? Of course, it's very easy to do. If you know the amount of oil \_\_\_\_\_ under the surface of the Earth and the rate at which it is being \_\_\_\_\_, fairly simple calculations can \_\_\_\_\_ determine its remaining life.

## II. Discuss the following problems:

1. The causes of energy crisis.
2. The way out of the situation. What can be done to solve the pressing problem?

### B. Read and translate Text IV. Think of a title to it. Underline the key sentences of each paragraph.

#### Text IV

Petroleum geologist M. Hubbert believes that the end of the oil era is in sight. He calculated that the world's oil production would be 61 million barrels in 2003. In fact, it was much higher – 85.4 million barrels a day while world's oil consumption demand was 82.4 million barrels a day, that is, 24,000 barrels more than the previous year.

The United States having only about 5.5% of the world's population consumed more than 30% of all oil produced in 2003, while the Middle East with 56% of the world's population consumed 4% of the world's daily oil output.

Even to date China, with a fifth of the world's population and its fast growing economy, consumes only 4% of the world's daily oil output. It imports about 3 million barrels per day. It's a lot to be sure but far below American consumption.

So China has been running around the world signing oil deals with such countries as Japan, Sudan and Angola and paying the highest oil prices.

15 years ago China imported virtually no oil – it was self-sufficient. But as China's economy has surged ahead at 10% a year, its own supplies of oil have begun to dry up. Its demand for energy will double in the next 20 years. Such an increase would be unsustainable for the world's environment.

“Nature has given enough to meet man's need but not enough to meet man's greed”. – said Mahatma Gandhi.

15 years ago, the roads of Beijing were empty, save for constant streams of bicycles. To day they are jammed from morning till late at night with more than three million private cars. By 2020 China will have 140 million cars, even more than the United States. So China, partially, is to blame for more than \$90 a barrel oil prices. According to G. Brock, an energy analyst, “China is only one of many factors pushing oil prices up. The cost of getting oil out of the ground is going up, the amount of water in it is increasing and there's less and less of the really good oil down there. All this is forcing the prices up”. The oil is going to run out and sooner than many of us may realize.

So what will China do when the oil runs out?

(to be Continued)

#### Notes:

1. in sight – виден (видется)
2. daily oil output – ежедневная добыча нефти
3. it was self-sufficient – зд. он (Китай) обходился своей нефтью
4. to dry out – иссякнуть (исчерпаться)
5. unsustainable – непереносимый, губительный; непоправимый вред
6. save for- кроме, за исключением
7. is to blame – зд. можно винить (обвинять)
8. pushing oil prices up – зд. приводящих к росту цен

**I. Comprehension check up.**

1. Think over the answer to the question above.  
What option would you recommend?
2. How much oil was produced and consumed in the world in 2003?
3. What countries are the main oil consumers?
4. What factors are pushing up oil prices?

**II. Express your opinion on the information presented in Text IV, using the following phases:**

In my opinion; is wrong/right; the data are true to fact; the facts were presented in; these facts are well known; it is common knowledge; are known far and wide; as far as I know; as a matter of fact; in fact/actually; prices go up (down)/rise (fall); oil production (output, consumption) falls (rises)/increased/decreased; oil reserves; run out/last.

